This is a collation of some of the world’s railway formal inquiry reports. It includes a brief incident synopsis, along with the main causes and recommendations from each investigation. Readers may find some of the actions and recommendations useful to their own operations.

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Contents: (click to navigate)

Bulgaria: Train fire between Lesicheri and Resen, 20 July 2011
Spain: Passenger train collision and derailment at El Clot-Aragó station, Barcelona, 28 April 2011
UK: Boiler incident on the Kirklees Railway, 3 July 2011
Czech Republic: Level crossing collision and subsequent derailment between Napajedla and Spytihnev, 8 June 2011
France: Freight train derailment near Neufchateau, 22 May 2010
UK: Partial failure of Bridge 94, near Bromsgrove, 6 April 2011
UK: Collision between a train and tractor at White House Farm user worked

Key issues in this edition:

- Train fires
- On-train fire fighting equipment
- Fire fighting training
- Locomotive maintenance
- Permissive working
- Poor safety management system
- Level crossing user behaviour
- Wagon design and maintenance
- Bridge examination process and practice
- Access to, and quality of, asset information
- Level crossing user error
- Poor safety critical communications
- Level crossing sighting distances and signage
- Operation of user-worked crossings (including lists of authorised users)
- Level crossing risk assessments
- Passenger evacuation
Bulgaria: Train fire between Lesicheri and Resen, 20 July 2011

At 17:23 (local time) on 20 July 2011, a Sofia–Varna passenger service caught fire between Lesicheri and Resen.

At 17:20, the assistant driver noticed that one of the carriages was ablaze and that flames were coming from the horizontal ventilators. He told the driver, who immediately applied the brakes, bringing the train to a stand from 73 mph in 200 metres.

Once the train had stopped, the driver and his assistant took fire extinguishers from the locomotive to start to tackle the flames coming from the horizontal ventilation fans, while the rest of the crew began to evacuate the passengers.

The driver and assistant were unable to quash the flames, which had begun to enter the engine room. The assistant driver decided to uncouple the locomotive and leading carriage. However, the coupler assembly had become overheated, preventing the assistant driver from doing so.

There was an explosion on the left-hand side of the locomotive, which turned out to be a battery, whose demise meant that the locomotive would not be able to move under its own power.

Due to strong winds in the area, the fire soon engulfed the first carriage and eventually spread to the second one. With the assistance of all crew and some passengers, the second and third carriages were successfully uncoupled, with all involved managing to push the remaining three vehicles a safe distance of about 30 metres away.

The first emergency call to the fire service had been made at 17:24, however due to the collapse of a nearby bridge, the fire engines had to be re-routed. The fire service arrived on site at 18:30 (local time). The blaze was localised at 19:00.

As a result of the fire, the locomotive and first two carriages were completely destroyed. Thankfully, there were no reported injuries or fatalities.

The investigation concluded that the most likely source of fire was an accumulated oil-dust layer on the electric motor of the locomotive’s air ventilator, which ignited from intensive sparking from the motor’s collector.

Recommendations

- The train operator should take appropriate measures and actions for:
  - Changing the locomotive fire extinguisher installation with a more efficient one;
  - Replacing the extinguishing agent currently used with a more modern one, to increase the efficacy of firefighting;
  - Exploring the possibility of providing pyro-extinguishing cartridges to aid the timely and reliable suppression of a fire;
  - Replacing locomotive rectifier units with new dry capacitors at planned maintenance exams;
  - Upgrading the fire alarms on locomotives of the same class;
  - Ensuring the timely correction of any locomotive oil leaks;
Worldwide FI Summary

- Conducting special training for train crew on what to do in cases of on-train fires. The particulars of the present case should form part of that training;

- Exploring the possibilities for applying thermographic cameras for diagnostic purposes when locomotives are on depot.

Declared to ERA 9 March

**Spain: Passenger train collision and derailment at El Clot-Aragó station, Barcelona, 28 April 2011**

At 09:49 (local time) on 28 April 2011, a commuter service overran a permissive signal and struck the rear of an empty coaching stock train in a tunnel at El Clot-Aragó. The commuter service derailed. Eighteen passengers received minor injuries.

The investigation concluded that the accident was caused by driver error.

**Recommendations**

- None issued.

Published 13 March

**UK: Boiler incident on the Kirklees Railway, 3 July 2011**

On Sunday 3 July 2011, a steam locomotive hauling a passenger train on the Kirklees Light Railway ran low on water. The crew did not take prompt action to deal with the situation and the boiler overheated, damaging the locomotive and giving rise to a risk of injury if the overheated metal had ruptured.

The cause of the incident was that the driver did not make sure enough water was put into the boiler during the journey and did not remove the fire from the locomotive when he realised the water had run low. The driver had just completed his training for driving steam locomotives. The underlying cause was that the Kirklees Light Railway’s safety management system was inadequate to deal with the risks arising from the operation of a steam railway.

**Recommendations**

- The Kirklees Light Railway should, within a timescale agreed with the ORR, complete and fully implement a safety management system that is comparable with good practice in the heritage sector, and relevant standards and guidance. This should include the identification of risks, determination of safety critical elements of competence and the training and assessment to deliver it. The Kirklees Light Railway should confirm that the recently-introduced training syllabus and competency arrangements are consistent with this.

- The Kirklees Light Railway should revise its locomotive preparation checklist to clarify which items must always be checked and which are dependent on the outcome of other checks.

Back to top
Declared to ERA 19 March

Czech Republic: Level crossing collision and subsequent derailment between Napajedla and Spytihnev, 8 June 2011

At 11:53 (local time) on 8 June 2011, a lorry collided with a passenger train at a level crossing causing the locomotive and first carriage to derail.

The cause of the accident was found to be lorry driver error. There were no reported injuries or fatalities.

The accident caused an 8½-hour delay.

Recommendations
● None issued.

Back to top

Declared to ERA 21 March

France: Freight train derailment near Neufchateau, 22 May 2010

At 10:45 (local time) on 22 May 2010, the rear four wagons of a freight train derailed near Neufchateau station. The immediate cause was a broken wheel on the 27th wagon in the consist. Three of the derailed wagons were loaded with dangerous goods. One containing phenol was found to be leaking.

The investigation found the underlying causes to be failures in wagon design and maintenance.

Recommendations
● Tests to assess actual stresses on wagon wheels should be undertaken.
● Procedures and practices for detecting cracked wheels should be improved.
● The rules concerning wagon maintenance should be overhauled.

Back to top

Published 22 March

UK: Partial failure of Bridge 94, near Bromsgrove, 6 April 2011

For the full report, click here: [LINK](#)

On Wednesday 6 April 2011, a Network Rail assistant track section manager (ATSM) discovered a structure (Bridge 94, on the main line between Birmingham and Gloucester) supporting the track which he believed to be collapsing. He was on site to check a hole in the ballast under sleepers on the down main line, first identified during a routine track inspection eight days previously, which had reappeared despite being filled with clean ballast.

The ATSM arranged for track maintenance staff to attend site during the evening to monitor the track. They discovered that ballast was falling into a watercourse under each passing train, and reported the failure to Network Rail’s fault control. Staff on site arranged an emergency speed restriction, followed by the diversion of trains onto other lines to bypass the failing structure. There were no injuries, but severe disruption continued until after emergency repairs were complete 36 hours later.
Nobody had inspected the part of the structure where the failure occurred since 2001 because neither Railtrack/Network Rail nor their structures examination contractor recognised the need for staff who were trained and equipped to enter a confined space to examine this structure. Consequently the condition of the part of the structure supporting the track was unknown.

RAIB concluded that the line became unsafe because of the partial failure of an under-track structure.

The causal factor was:

- The roof of the structure was damaged by impact loading originating from train wheels passing over an adjustment switch which had been installed above, creating a minor, but recurring dip in the track.

RAIB found the following ‘possible causal factors’:

- Examiners carrying out visual checks were not required to enter the structure; therefore, this gave no opportunity to identify the condition of the track-supporting structure.

- The detailed examination undertaken in October 2005 did not include an examination of the area which subsequently failed;

- The examining engineer who reviewed the 2005 examination report did not identify that additional resources were required to complete the task, and the opportunity to identify whether remedial work was necessary was therefore.

An underlying factor was that reference information available to Network Rail staff about Bridge 94 was poorly collated and inaccessible.

A factor that exacerbated the consequences of the event was that staff responsible for track design and maintenance did not have information on the location of undertrack structures.

RAIB observed that the process of identifying structures requiring special access arrangements, solely by reference to existing reports (ie without reconnaissance visits), has repeatedly failed to identify the confined space hazard at Bridge 94.

In the course of its investigation, RAIB became aware of a study by Thames Water which has identified gaps in the management of water-carrying structures that pass under railway land. In some cases, Network Rail’s knowledge of their location or condition is incomplete. This has led to damage occurring during track maintenance, tamping, drainage works, bank stabilisation or electrification work, and the lack of a maintenance programme for these assets.

**Actions reported as already taken or in progress relevant to this report**

**Improvement Notices issued by the ORR**

On 13 May 2011, the ORR served an Improvement Notice on Network Rail (Western Route) after finding evidence of incomplete examination reports. In summary, this notice applied to structures and culverts and required Network Rail to:

- Introduce a system to identify incomplete examinations;

- Assess risks from incomplete examinations and take action to complete them.

In response, Network Rail (Western Route) has undertaken an exercise to review the examination reports for all 5000 culverts and 4000 underbridges within the route. This review aimed to identify incomplete examination reports and structures where access is constrained making examination difficult. As a consequence, 3% of the culvert and 0.5% of the underbridge population were classified as high risk (ie those that supported the track where structures examinations were incomplete) and will be subject to further action. The study found no cases that were judged by Network Rail to present as serious a safety risk as Bridge 94.
On 20 May 2011, ORR served an Improvement Notice on Network Rail nationally on the basis that Network Rail did not have ‘suitable and sufficient measures in place for ensuring that non-earthworks structures are fully examined and reports of those examinations are evaluated at appropriate intervals to enable [Network Rail] to determine whether and to what extent remedial works are required to ensure that the structures remain capable of safely carrying the imposed loads; whereby rail users may be exposed to increased levels of risk to their safety’. The Notice included a schedule of six areas which the ORR required Network Rail to address. The issue of this Notice was in response to work undertaken by the ORR during 2010, and was not directly related to the incident at Bromsgrove.

Network Rail’s response to the issues identified in the Improvement Notice has included further development of its structures examinations database (CARRS), which was first introduced in December 2008 and is used as an asset management tool to schedule examinations and as a maintenance database. The upgrade is intended to address weaknesses in data quality, caused by migration from different legacy systems, which had made it difficult for Network Rail to identify incomplete examinations. This will require decisions to be recorded, particularly where this relates to non-compliances (eg parts not examined). CARRS will also provide an electronic link to Amey’s ALARM database to give users greater visibility of the status of reports. The ORR has accepted Network Rail’s responses and closed the Improvement Notice on 30 November 2011.

**Actions reported that address factors which otherwise would have resulted in a RAIB recommendation**

Network Rail has repositioned the adjustment switch at 55 miles 61.5 chains to move it away from Bridge 94.

**Learning points**

The RAIB has identified one learning point for the railway industry:

- Network Rail should remind its examination contractor(s) of the importance of undertaking reconnaissance visits as an integral part of the planning process for detailed examinations, and consider whether it can assist by providing the list of detailed examinations in sufficient time to allow the examinations contractor(s) to plan accordingly. For example, consideration should be given to providing a list of forthcoming detailed examinations in time for reconnaissance to be undertaken concurrently with the previous visual examination.

**Recommendations**

- Network Rail should introduce a programme of marking the position of all track-supporting structures which are not apparent from the surface, so that their presence can be taken into account by those responsible for managing incidents, maintaining the railway, and designing and upgrading infrastructure.

- Network Rail should review the ways in which it visually examines those structures which cannot be seen from a safe observation location and where access is constrained. This review should consider the ways in which effective examinations can be carried out, and where this cannot be achieved, alternative measures to manage the risk. Any necessary improvements to the examinations regime identified in the review should be implemented.

- Network Rail should improve reference information available to those responsible for reviewing structures examination reports, to enhance the accuracy and effectiveness of the report review and evaluation processes.
At approximately 10:13 on Sunday 25 September 2011, a Kings Lynn–Ely First Capital Connect service struck a tractor on White House Farm user-worked crossing (UWC). The impact caused the front of the tractor to be separated from the driving cab. The tractor driver remained in the cab of the tractor, but suffered a broken collarbone, lacerations and bruising.

The tractor moved onto the crossing when the train was no more than 100 metres away and travelling at 70 mph. The train driver sounded the horn and applied the emergency brake, but was unable to prevent the collision. The second wheelset on the train derailed after the collision occurred, but the train remained upright and in line while stopping. The train driver suffered a chest injury and shock in the accident. No-one else on the train was injured.

Evacuation of the passengers took place after three hours because equipment providing electrical power to trains had become dislodged and was hanging close to the track.

At the time of the accident, there were frequent movements of tractors and trailers over the crossing because of activity associated with the harvesting of sugar beet in an adjacent field. The tractor driver was telephoning the signaller at Kings Lynn to ask for permission to cross on each occasion. This was not the normal method of working: usually, crossing users would check that it was safe to cross before doing so and the signaller at Kings Lynn would not be aware that the crossing was being used.

The collision between the train and the tractor occurred because:

- The signaller gave permission for the tractor driver to cross the railway before establishing that the train had passed;
- The tractor driver moved onto the crossing immediately that the signaller gave permission for him to do so; and
- The method adopted for working White House Farm UWC during the period of intensive use had not identified and controlled the potential risk arising from mis-communication between the signaller and the tractor driver.

The consequences of the accident were affected by the unavailability of local staff trained to earth the overhead line equipment, which delayed the evacuation of the train by up to 75 minutes.

RAIB also observed that:

- The sighting distance from White House Farm UWC towards Kings Lynn had not been accurately measured by Network Rail;
- The way in which vehicles used White House Farm UWC had not been considered when data gathering for risk assessments of the crossing had been undertaken;
- The signage at the crossing was confusing and one of the telephone numbers identified on a sign did not work; and
The information held by Network Rail about the authorised user at White House Farm UWC was not up-to-date.

**Actions reported that address factors which otherwise would have resulted in a RAIB recommendation**

Network Rail has:
- Re-assessed sighting distances at White House Farm UWC and found that they are not compliant. Network Rail intends to install telephones at the crossing to provide users with a direct means of communication with the signaller before they cross.
- Restored the telephone number which had previously been out of use.

Updated its records regarding the authorised user at White House Farm UWC.

**Recommendations**
- None issued.

**Learning points**
- Signallers need to be made aware of the need to ensure that safety-critical messages are delivered in the right way (this is particularly important when dealing with people who are not used to receiving / sending safety-critical information). The voice recording from this accident would form useful training material for Network Rail to illustrate to signallers the effects of getting the order of the words wrong.
- Where Network Rail becomes aware that non-standard methods are to be applied to operating a UWC, it is important that all parties involved jointly review the proposed method of working which should then be documented and confirmed in order that misunderstandings can be avoided.
- At remote locations, the availability of staff trained in earthing overhead line equipment may assist in speeding up train evacuations and help to expedite fire-fighting.
- There is a need to remind staff that sighting distances are critical to the assessment of safety at crossings and that they need to be sure that trains can actually be seen at the chosen sighting point when standing at a crossing.
- The accuracy of the level crossing risk assessment process is enhanced when engagement with authorised users at UWCs includes consideration of how a crossing is used so that a reasonable worst case for sighting at the crossing can be identified.
- Maintenance visits to level crossings should include a check that telephone contact details are correct and functioning and crossing risk assessments should also consider the clarity and accuracy of the information displayed to the user.
- It is important that information held on authorised users is current.